Eligibility of Internet2 Access for discounts under the federal universal support program for K-12 schools and libraries

CC Docket No. 02-6

May 8, 2002

Jeff Ogden, jogden@merit.edu
Director, High Performance Networking
Merit Network, Inc.

Internet2 Access Eligibility

Internet2 access from eligible K-12 schools and libraries should be eligible for universal service support discounts either:

(1) As "Internet access" under existing universal service regulations, or

(2) As an "Advanced Information Service" under 47 USC 254(h)(2)(A)

Names

- Commodity Internet (aka Internet1)
- Internet2 (the name for an organization, a project, a consortium, a network, a collection of networks)
- UCAID (University Corporation for Advanced Internet Development)
- Abilene (high performance Internet2 backbone network operated by UCAID)
- vBNS (very high-speed Backbone Network Service, original high performance network sponsored by NSF, vBNS+ is a commercial offering now operated by MCI/Worldcom)
- GigaPoP (Internet2 Point of Presence)

Today's Commodity Internet

- Commodity Internet (it might be called Internet1)
- Growing rapidly (at least doubling every year)
- Capacity/capability lags applications
- Increasingly focused on the mass market rather than on the more specialized needs of research and education
- Mission critical applications seldom pursued on commodity Internet
  - Authentication done in scattered manner
  - "best effort" not good enough when performance is critical
  - Intranets and Extranets used instead

Internet2 Mission

Develop and deploy advanced network applications and technologies for research and education, accelerating the creation of tomorrow's internet

Translation:

- We're nowhere near done inventing the Internet
- Great potential to transform research and education
- The commercialization of the Internet has meant a focus on money making issues and has short-circuited exploration and invention
- Internet2's goal is to encourage the development and use of new network applications that will not work or will not work well on today's commodity Internet

Internet2 Applications

- Video – in all forms, probably the "killer" application
  - Two-way interactive, one-way, streaming
- Multimedia resources for "papers"
- Remotely controlled instruments, devices
- Computationally intensive distributed applications
- Very large and/or distributed databases
- Peer-to-peer applications
- Others to be discovered

Examples of Internet2 Applications for K-12 Schools

- Language Students Talk with Students in a Foreign Country
- Music Students Benefits from Distant Teacher
- Virtual Field Trips
- Helping Schools, Ed Schools, Student Teachers Interact
- Remote Use of an Electron Microscope
- High Definition Video from the International Space Station

- Live from the Kennedy Center for the Performing Arts
- Virtual Anatomy
- Truman Presidential Library
- Individual 2000 Census Data
- Showing Students What's Happening

Music Teaching

ASL Poetry

Georgetown University
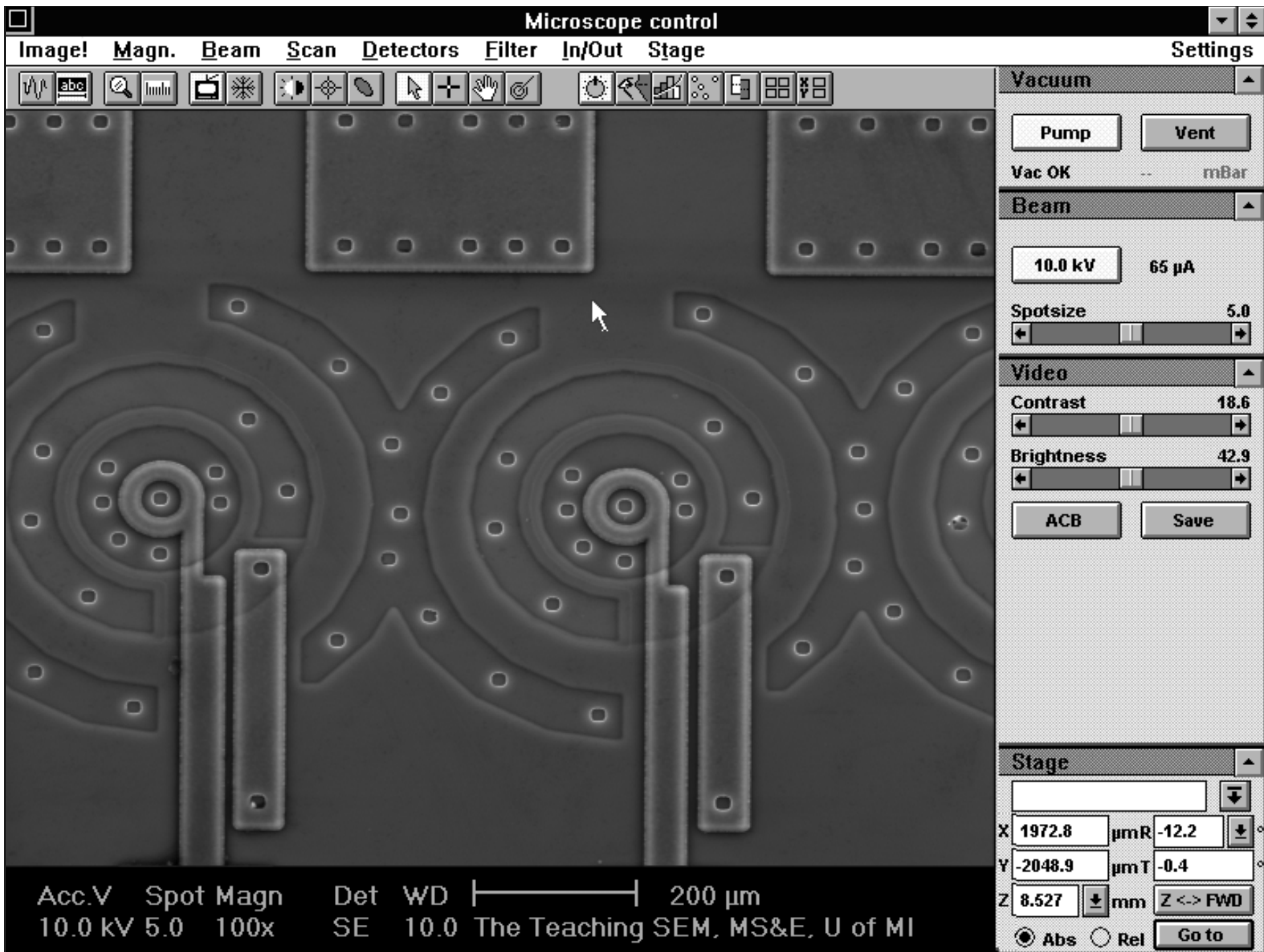
Visual History Foundation

- www.vhf.org

- Over 50,000 interviews of Holocaust survivors

- Digitized as over 250,000 hours of MPEG1 video stored on a network accessible server

- A resource for tolerance education

Remote Scanning Electron Microscope
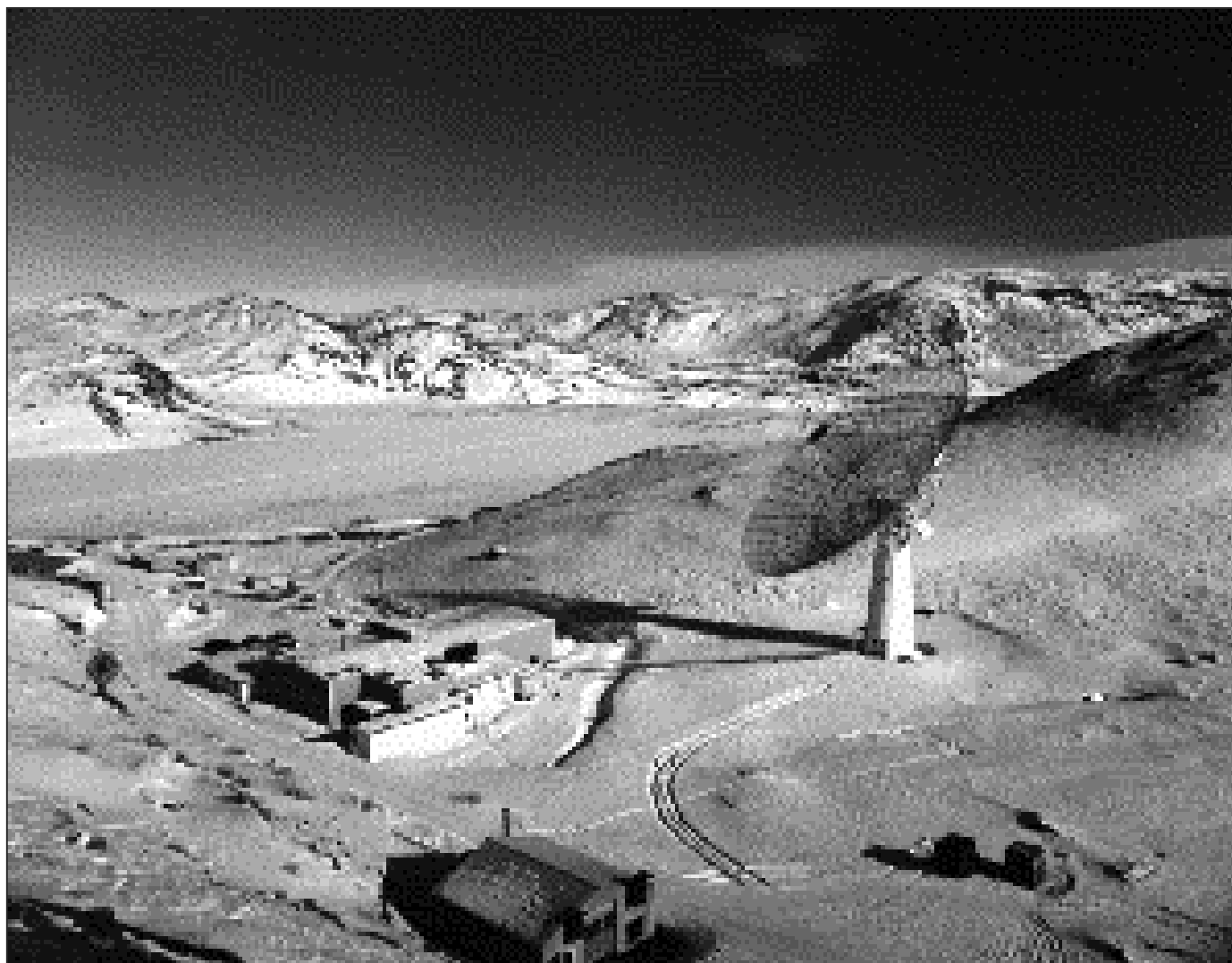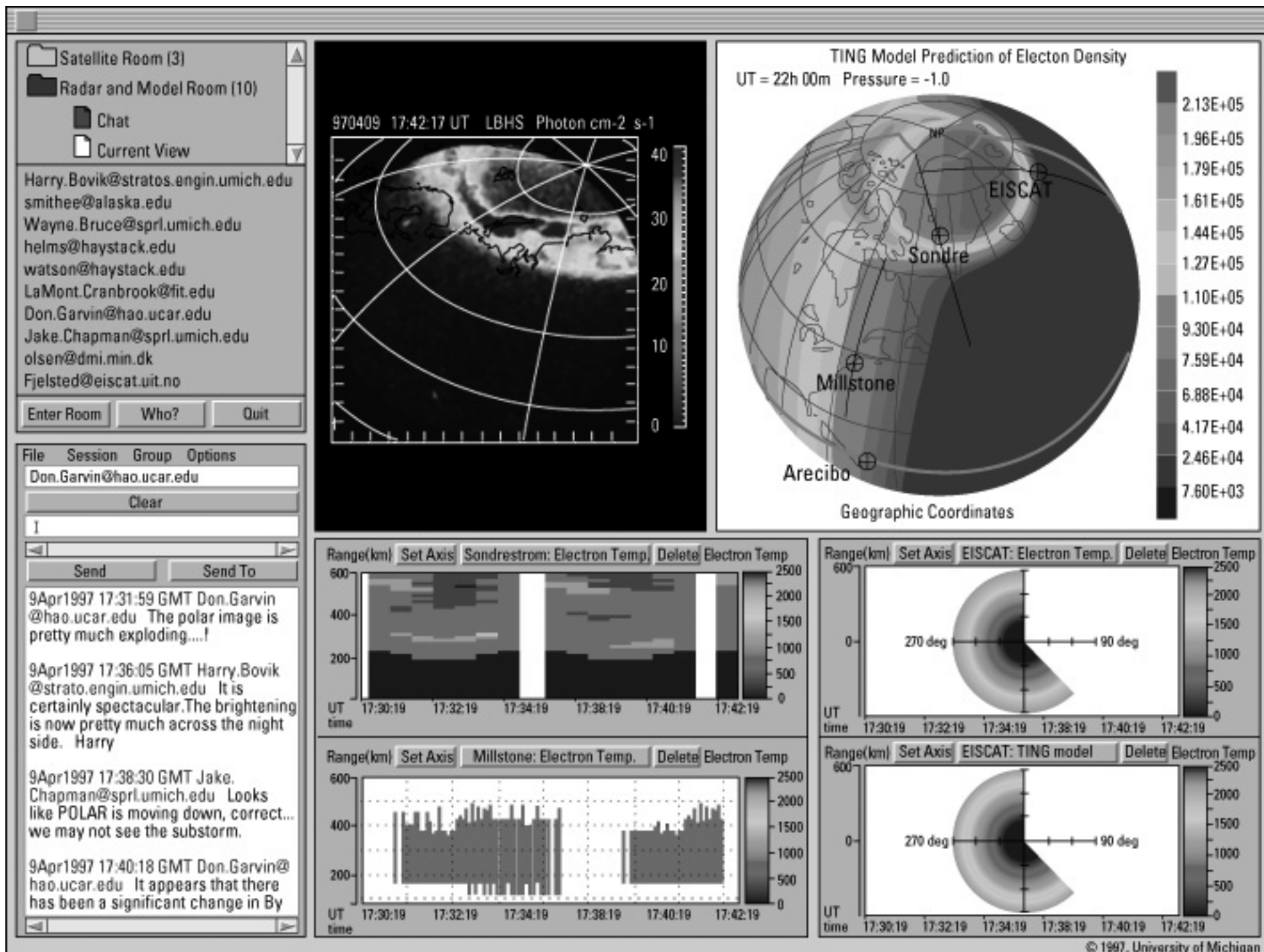

Philips XL30

University of Michigan

Tele-vator

- Excavation backhoe operated remotely over Internet2

- Used in hazardous rescue situations

- Sophisticated two-way feedback using stereovision

14

Satellite Room (3)
Radar and Model Room (10)
  Chat
  Current View

Harry.Bovik@stratos.engin.umich.edu
smithee@alaska.edu
Wayne.Bruce@sprl.umich.edu
helms@haystack.edu
watson@haystack.edu
LaMont.Cranbrook@fit.edu
Don.Garvin@hao.ucar.edu
Jake.Chapman@sprl.umich.edu
olsen@dmi.min.dk
Fjelsted@eiscat.uit.no

Enter Room   Who?   Quit

File   Session   Group   Options
Don.Garvin@hao.ucar.edu
Clear

Send   Send To

9Apr1997 17:31:59 GMT Don.Garvin
@hao.ucar.edu   The polar image is
pretty much exploding....!

9Apr1997 17:36:05 GMT Harry.Bovik
@strato.engin.umich.edu   It is
certainly spectacular.The brightening
is now pretty much across the night
side.   Harry

9Apr1997 17:38:30 GMT Jake.
Chapman@sprl.umich.edu   Looks
like POLAR is moving down, correct...
we may not see the substorm.

9Apr1997 17:40:18 GMT Don.Garvin@
hao.ucar.edu   It appears that there
has been a significant change in By

970409 17:42:17 UT   LBHS   Photon cm-2 s-1

TING Model Prediction of Electon Density
UT = 22h 00m   Pressure = -1.0

NP
EISCAT
Sondre
Millstone
Arecibo

Geographic Coordinates

2.13E+05
1.96E+05
1.79E+05
1.61E+05
1.44E+05
1.27E+05
1.10E+05
9.30E+04
7.59E+04
6.88E+04
4.17E+04
2.46E+04
7.60E+03

Range(km)   Set Axis   Sondrestrom: Electron Temp.   Delete   Electron Temp
600
400
200
UT time   17:30:19   17:32:19   17:34:19   17:38:19   17:40:19   17:42:19

Range(km)   Set Axis   Millstone: Electron Temp.   Delete   Electron Temp
600
400
200
UT time   17:30:19   17:32:19   17:34:19   17:38:19   17:40:19   17:42:19

Range(km)   Set Axis   EISCAT: Electron Temp.   Delete   Electron Temp
600
0   270 deg   90 deg
UT time   17:30:19   17:32:19   17:34:19   17:38:19   17:40:19   17:42:19

Range(km)   Set Axis   EISCAT: TING model   Delete   Electron Temp
600
0   270 deg   90 deg
UT time   17:30:19   17:32:19   17:34:19   17:38:19   17:40:19   17:42:19

Internet2 access is Internet access

- The networks that make up Internet2 are part of the worldwide network of TCP/IP networks that is the Internet
- All sites on Internet2 are also on the commodity Internet
  - usually with a single connection to both
  - but sometimes with separate connections to each
- Internet2 and the commodity Internet both use the TCP/IP protocols (IPv4 and IPv6)
- Both use the same IP addresses, domain names, LANs, computers, browsers, and many other applications
- Often hard for end users to know if they are using Internet2 or the commodity Internet

Internet2 is not a single network

The Abilene backbone connects:

- Research and education organizations (R&E)

- GigaPoPs, which in turn connect:

  - Research and education organizations

  - Businesses that are collaborating with R&E, and

  - State education networks, which in turn connect:

    - Schools, school districts, libraries, and library systems

- The vBNS and vBNS+

- Federal agency networks (NASA, DOD, DOE)

- International research and education networks

Internet2 Connectivity Cloud (includes vBNS)
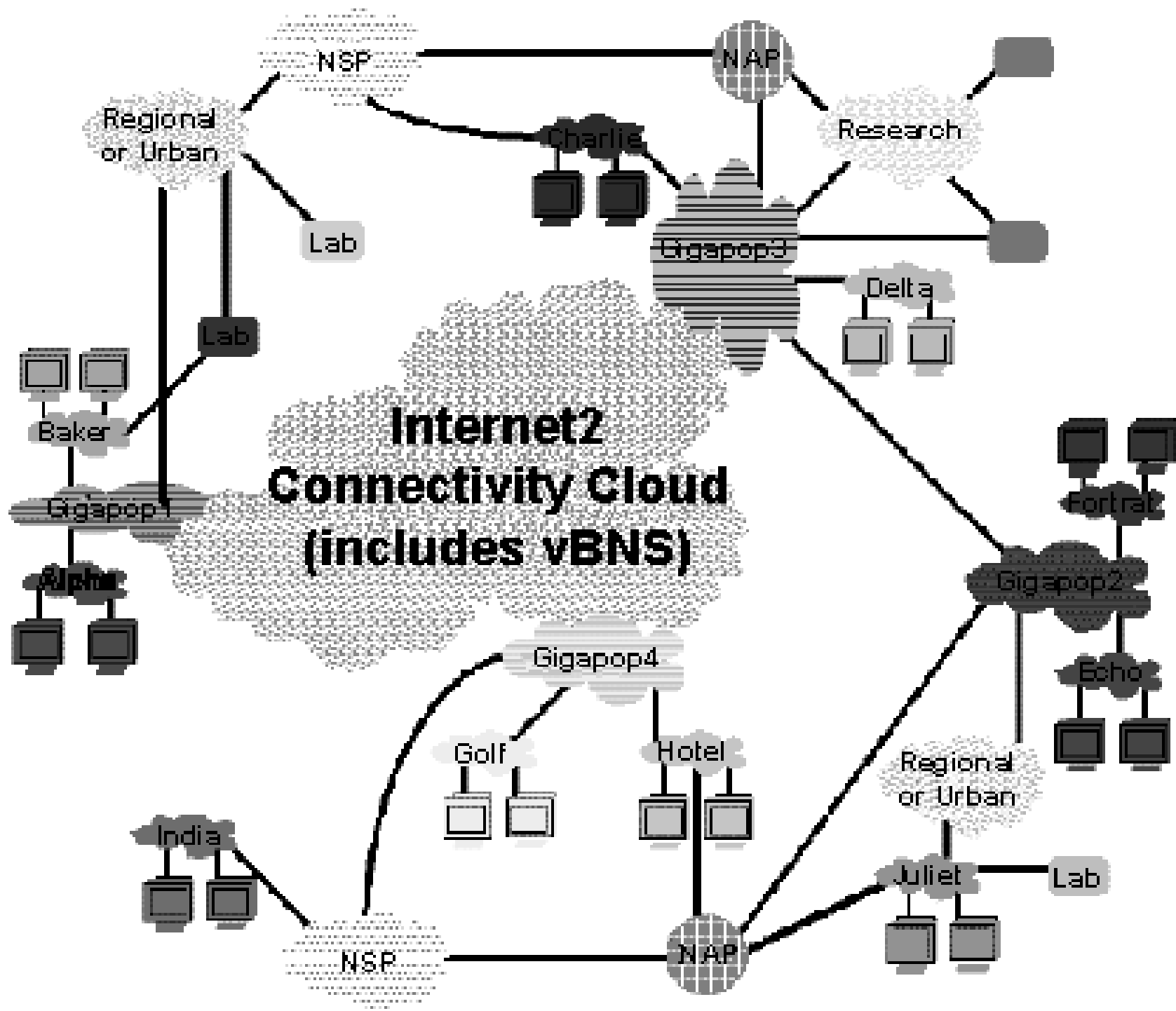
GigaPoPs

- Very high speed regional aggregation points or Points of Presence

- Organizationally separate from Internet2/UCAID

- Most Internet2 access is provided by GigaPoPs and not directly by Internet2/UCAID

- Some GigaPoPs are state educational networks, others provide connections to state educational networks

- GigaPoPs may or may not also provide commodity Internet access

- Merit operates the Michigan GigaPoP
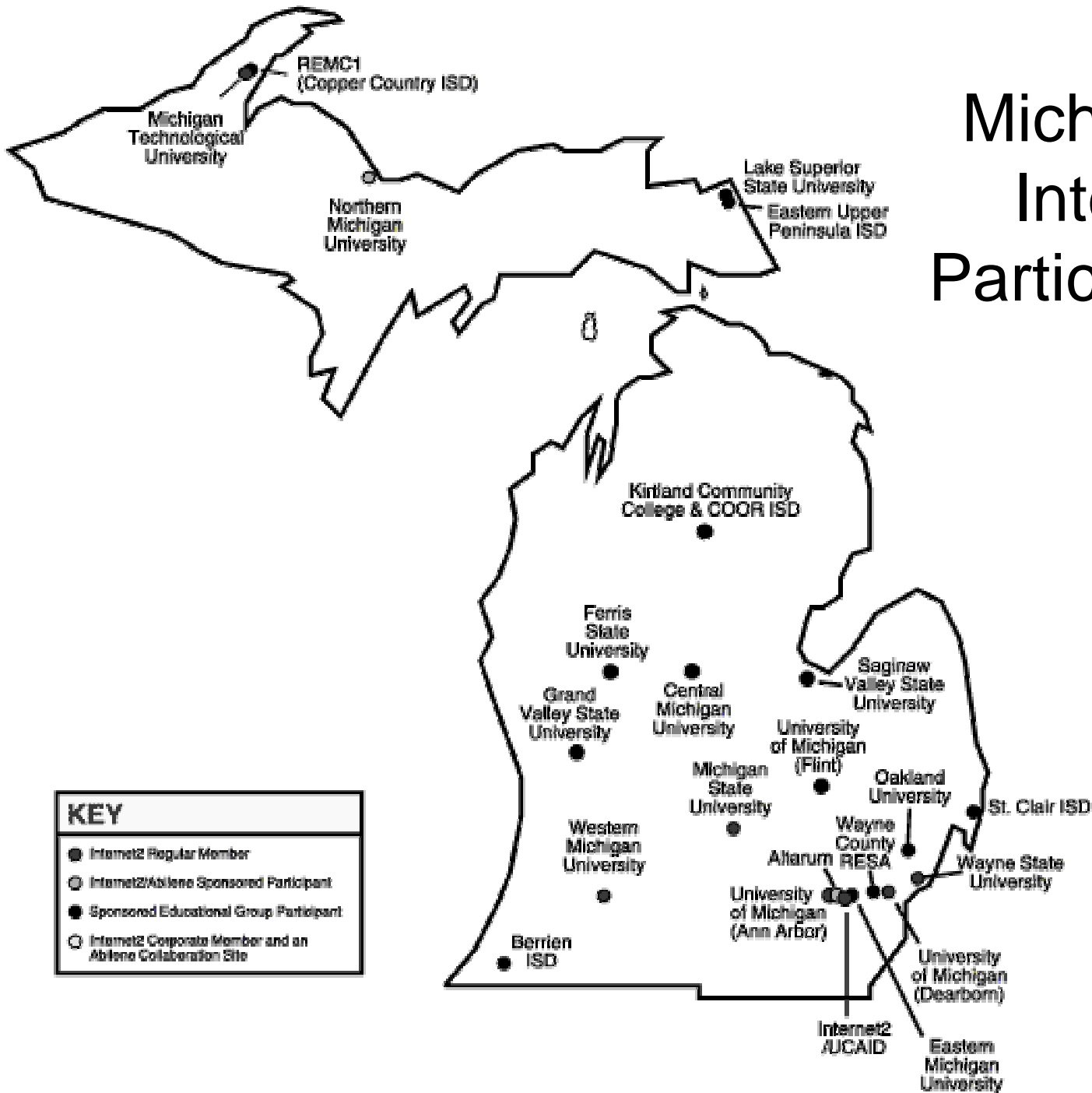
- MichNet *is* the Michigan GigaPoP

Internet2 GigaPoPs
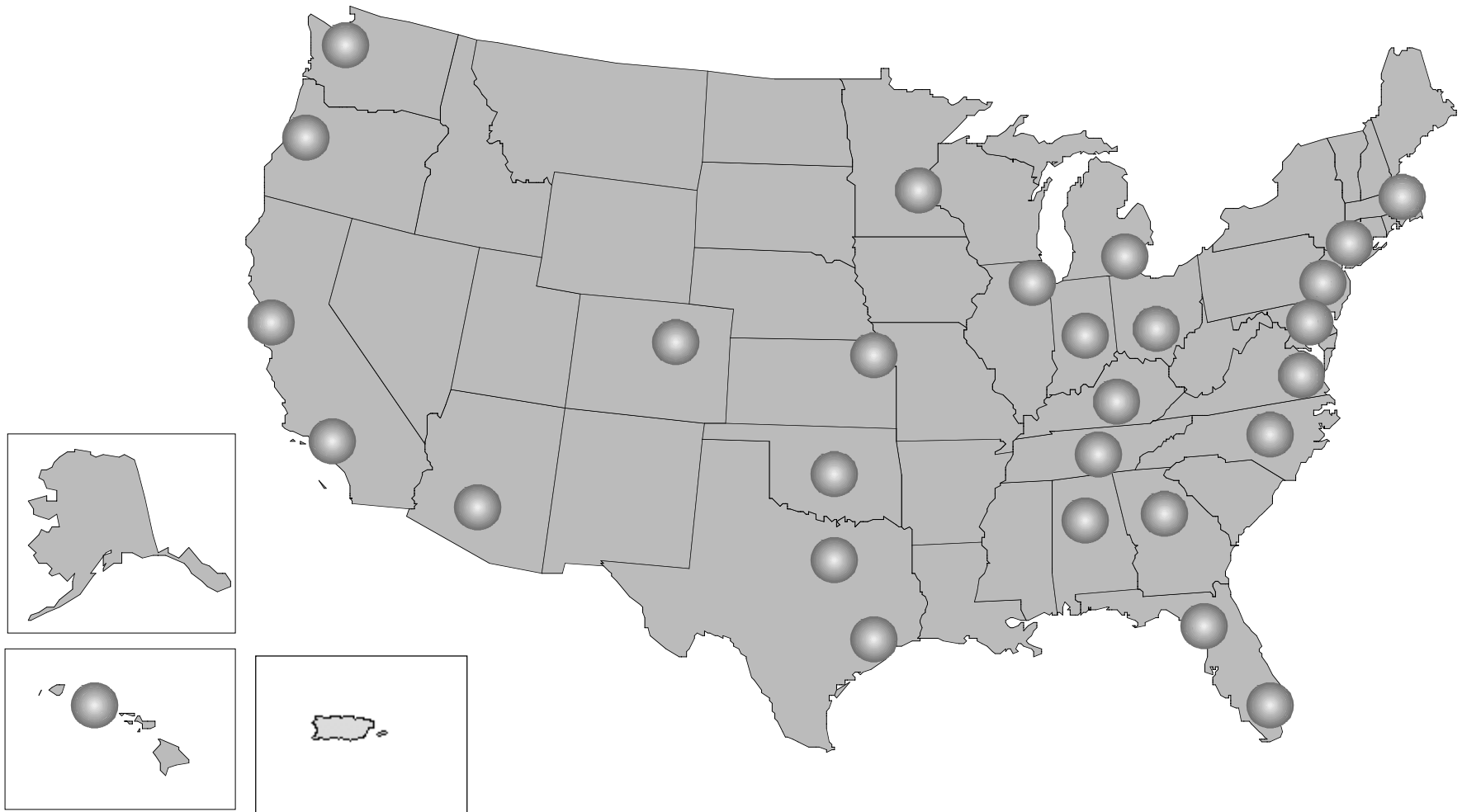
Sponsored Educational Group Participation (SEGP)

- Allows Internet2/Abilene access for educational organizations that are not members of Internet2:
  - Private colleges and universities
  - K-12 schools
  - Community colleges
  - Libraries and Museums
  - Hospitals and clinics involved in education
- Non-educational organizations can also participate, but need to be individually sponsored
- This is access, it is not membership in Internet2
  - Internet2 membership is not required, although it is an option for some organizations

Michigan's Internet2 Participants

REMC1
(Copper Country ISD)

Michigan
Technological
University

Northern
Michigan
University

Lake Superior
State University

Eastern Upper
Peninsula ISD

Kirtland Community
College & COOR ISD

Ferris
State
University

Saginaw
Valley State
University

Grand
Valley State
University

Central
Michigan
University

University
of Michigan
(Flint)

Oakland
University

St. Clair ISD

Michigan
State
University

Western
Michigan
University

Wayne
County
RESA

Altarum

Wayne State
University

University
of Michigan
(Ann Arbor)

Berrien
ISD

Internet2
/UCAID

University
of Michigan
(Dearborn)

Eastern
Michigan
University

KEY

- ● Internet2 Regular Member
- ○ Internet2/Abilene Sponsored Participant
- ● Sponsored Educational Group Participant
- ○ Internet2 Corporate Member and an Abilene Collaboration Site

22

International Networks

Americas

- CANARIE (Canada)
- CRNet (Costa Rica)
- CUDI (Mexico)
- REUNA (Chile)
- RETINA (Argentina)
- RNP, FAPESP/ANSP (Brazil)
- SENACYT (Panama)

Asia-Pacific

- AAIREP (Australia)
- APAN (Asia-Pacific)
- APAN-KR (Korea)
- APRU (Asia-Pacific)
- CERNET, CSTNET, NSFCNET (China)
- JAIRC (Japan)
- JUCC (Hong Kong)
- SingAREN (Singapore)
- NECTEC / UNINET (Thailand)
- TAnet2 (Taiwan)

Europe / Middle East

- ARNES (Slovenia)
- BELNET (Belgium)
- CARNET (Croatia)
- CESnet (Czech Republic)
- DANTE (Europe)
- DFN-Verein (Germany)
- GIP RENATER (France)
- GRNET (Greece)
- HEAnet (Ireland)
- HUNGARNET (Hungary)
- GARR (Italy)
- Israel-IUCC (Israel)
- NORDUnet (Nordic Countries)
- POL-34 (Poland)
- RCTS (Portugal)
- RedIRIS (Spain)
- RESTENA (Luxembourg)
- Stichting SURF (Netherlands)
- SWITCH (Switzerland)
- TERENA (Europe)
- JISC, UKERNA (United Kingdom)

Internet2 access is Internet access

"Internet access" includes the following elements (47 CFR 54.5):

(1) The transmission of information as common carriage;

(2) The transmission of information as part of a gateway to an information service, when that transmission does not involve the generation or alteration of the content of information, but may include data transmission, address translation, protocol conversion, billing management, introductory information content, and navigational systems that enable users to access information services, and that do not affect the presentation of such information to users; and

(3) Electronic mail services (e-mail).

Common Carriage

- Common carriage is the offering of service for a fee directly to the public, or to such classes of users as to be effectively available directly to the public

- Internet2 as a collection of advanced networks and gateways that serve a large number and wide range of research, higher education, K-12 schools, libraries, government agencies, other non-profit, and for-profit organizations throughout the world provides "common carriage"

Access, Content, and Membership

- Internet2 access for K-12 schools and libraries is provided by GigaPoPs or state networks
- Access to Internet2 is separate from access to content that may be available over Internet2
- Access to Internet2 does not require membership in Internet2
- Fees or portions of fees paid for access to content or for membership where membership includes more than network access should not be eligible for universal service discounts, just as they are not eligible for commodity Internet access

Current SLD Eligible Services List

Internet2 as a telecommunications Service

Internet2 is a consortium of universities, industry, and government for development and deployment of advanced network applications and technologies. A telecommunications link that connects an eligible entity to Internet2 is eligible for discount. Membership dues or any fees for non-telecommunications services are not eligible.

Eligible: Conditional

Proposed List Wording

Internet2 Access as a telecommunications service

Internet2 is a consortium of universities, industry, and government organizations working to promote the development and deployment of advanced network applications, services, and technologies.

A telecommunications link that provides an eligible entity with access to Internet2 is eligible for discount.

Internet2 access may be eligible as Internet Access. See the "Internet2 access" entry in the Internet Access section.

Eligible: Yes

Current SLD Eligible Services List

Internet2 as Internet access

Internet2 is a consortium of universities, industry, and government for development and deployment of advanced network applications and technologies. Membership dues or any fees for access to content are not eligible for discount.

A link that connects an eligible entity to Internet2 can be eligible as a telecommunications service. See the Internet2 entry in the Telecommunications Services section.

Eligible: No

Proposed List Wording

Internet2 access as Internet access

Internet2 is a consortium of universities, industry, and government organizations working to promote the development and deployment of advanced network applications, services, and technologies.

"Basic conduit access" to Internet2 is eligible for discount. See the "Basic Unbundled Access" entry in this section for more information.

Fees for membership or access to content to the extent that the fees include facilities or services beyond "basic conduit access" are not eligible for discount. See the entries for "Bundled Access", and "Internet content" in this section.

A link that connects an eligible entity to Internet2 can be eligible as a telecommunications service. See the "Internet2 access" entry in the Telecommunications Services section.

Eligible: Yes

Advanced Services for Schools, Libraries, and Health Care Providers

The Commission shall establish competitively neutral rules–(A) to enhance, to the extent technically feasible and economically reasonable, access to <u>advanced telecommunications and information services</u> for all public and nonprofit elementary and secondary school classrooms, health care providers, and libraries

[47 USC 254(h)(2)]

Internet2 Access as Advanced Information Service

- Universal service support discounts should be made available to K-12 schools and libraries for Internet2 access under 47 USC 254(h)

- Internet2 access an advanced Information Service of the kind that Congress wanted provide for K-12 schools and libraries

- Access to the the sorts of information and services available over Internet2 have the potential to transform education and are part of an evolving level of services that are essential to the future of education in the United States

Universal Service Principles

- Access to <u>advanced</u> telecommunications and information services should be provided in all regions of the Nation

    [47 USC 254(b)(2)]

- Elementary and secondary schools and classrooms, health care providers, and libraries should have access to <u>advanced</u> telecommunications services as described in subsection (h)

    [47 USC 254(b)(6)]

Universal Service Definitions

- Universal service is an <u>evolving level</u> of telecommunications services that the Commission shall establish periodically ..., taking into account advances in telecommunications and information technologies and services

    [47 USC 254(c)(1)]

- ... shall consider the extent to which such telecommunications services–(A) are <u>essential to education</u>, public health, or public safety
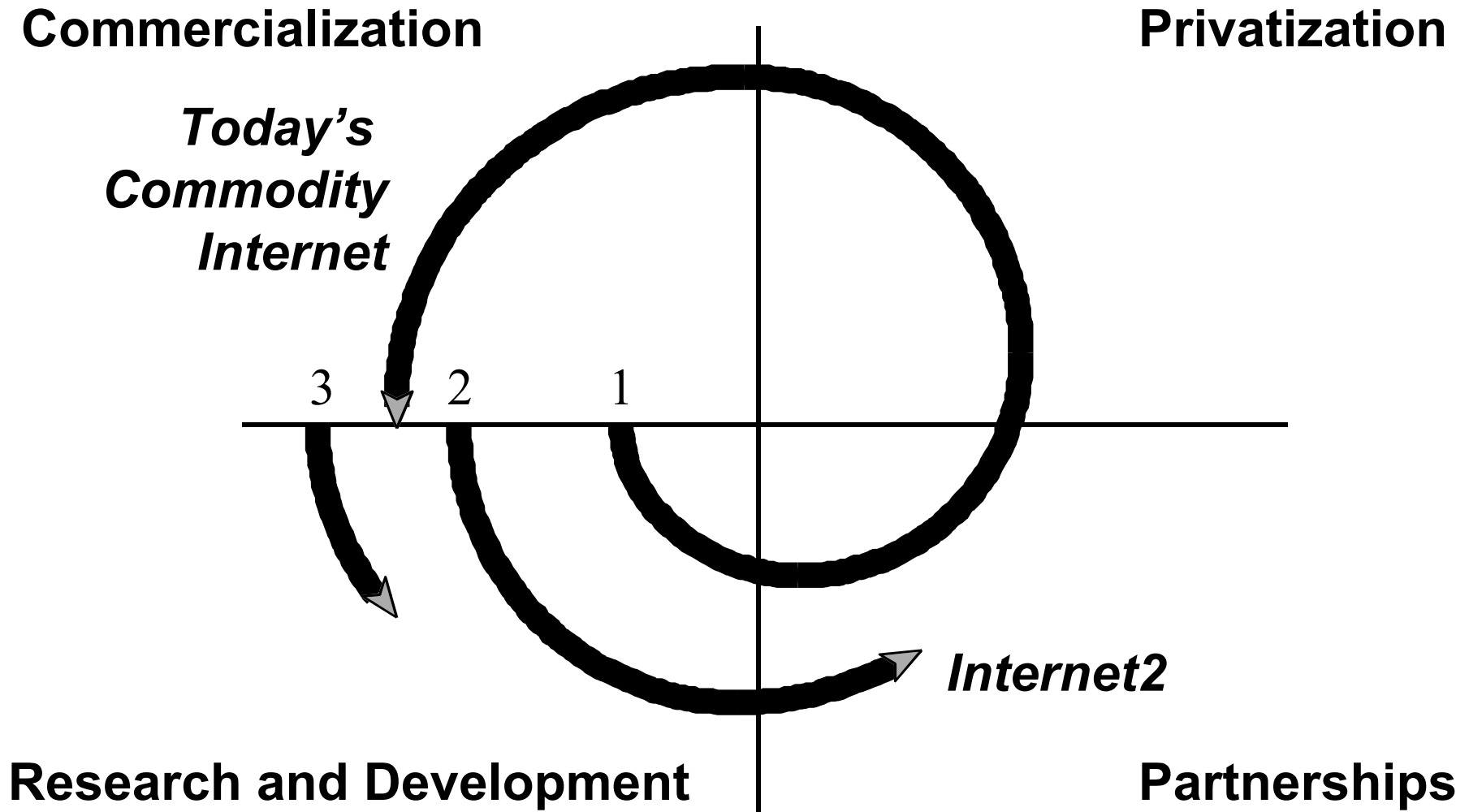
    [47 USC 254(c)(1)]

- ... the Commission may designate <u>additional services</u> for such support mechanisms for schools, libraries, and health care providers

    [47 USC 254(c)(3)]
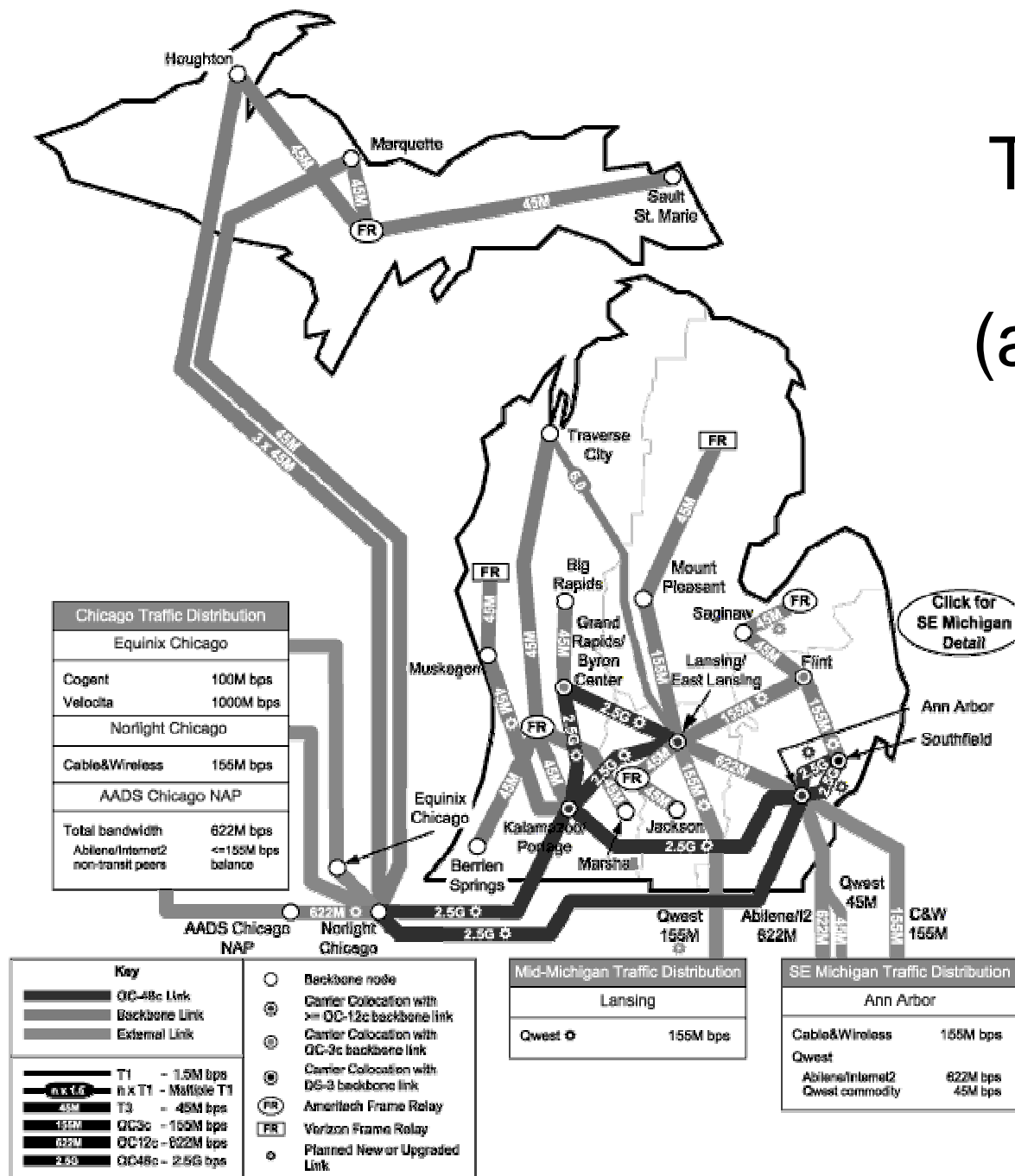
Internet Development Spiral

Commercialization　　　　　　　　　　　　　**Privatization**

Today's Commodity Internet

3　　2　　1

Internet2

Research and Development　　　　　　　　**Partnerships**

35

Background

- Merit is a non-profit 501(c)(3) corporation formed in 1966 to connect three Michigan universities

- Operates MichNet, part of the Internet in Michigan

- Operates the Michigan GigaPoP

- MichNet is the Michigan GigaPoP

- Merit managed NSFNET from 1987 to 1995

- Merit provides Internet services to over 250 organizations including public and private colleges and universities, community colleges, K-12 schools, libraries, federal, state, and local government agencies, health care organizations, and some for-profit businesses

The Michigan
GigaPoP
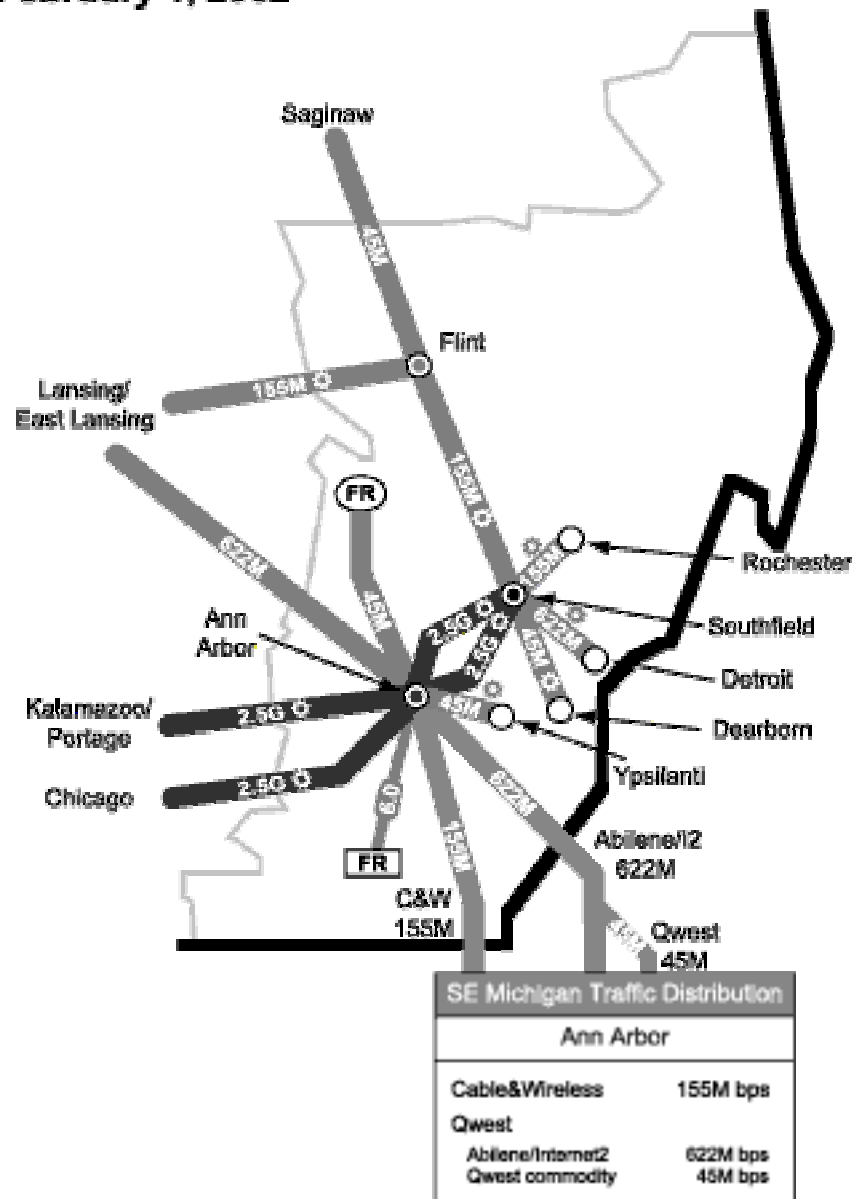(aka MichNet)
with planned
upgrades

MichNet Backbone
Southeast Michigan
Planned upgrades
February 1, 2002

Saginaw

45M

Flint

155M

Lansing/
East Lansing

622M

FR

Rochester

Ann
Arbor

Southfield

Detroit

2.5G

45M

Kalamazoo/
Portage

2.5G

Dearborn

Chicago

2.5G

Ypsilanti

6.0

155M

622M

Abilene/I2
622M

FR

C&W
155M

45M

Qwest
45M

SE Michigan Traffic Distribution	
Ann Arbor	
Cable&Wireless	155M bps
Qwest	
Abilene/Internet2	622M bps
Qwest commodity	45M bps

38

Merit's involvement in the E-rate

- A participant in the Michigan Information Network Work Group (MINWG), a volunteer effort to make E-rate information widely available and encourage schools and libraries to participate in the E-rate program
- A member of the SLD's Year 3 E-Rate Task Force
- An ISP that participates in the E-rate program and provides E-rate discounts to K-12 schools and libraries in Michigan

Additional Information

Additional information on Internet2 is available on the Web, see:

- www.internet2.edu
- www.merit.edu/i2/